Research project of counterparts funded at IPB

Name	Counterpart	Title
Damayanti Buchori	Z02	Monitoring of Coleoptera Community Patterns across Four Different Land-Use Systems

Background and Objectives

Arthropods' diversity in tropical forests represents a concentration of biodiversity globally (Watt & Zhorowski, 1997) and is an important organism with fundamental functions due to its many valuable performances in ecosystem services such as pollination, natural pest suppression and decomposition (Bennet & Lovvel, 2014). Studies of arthropods using canopy fogging provide a wealth of new information for scientists studying species abundance, composition, richness, herbivory, host specificity and guild relationship (Stork *et al.,* 1997; Progar & Schowalter, 2002). Some tropical insects are influenced by seasonal changes in temperature and rainfall (Tauber *et al.,* 1998; Guedes *et al.,* 2000), which might be crucial for understanding the dynamics in the assemblage of arthropod communities (Wagner, 2001) e.g. the abundance of Ensifera. They decrease around 2.5 times in the swamp forest, 3.1 times in the selectively logged forest and 3.4 times in the primary forest. So far, only a few studies have concentrated on seasonal changes and their effects toward arthropod diversity especially for the order Coleoptera. In this study, the number of Coleopterans were compared between dry and rainy seasons in adjacent plots of lowland rainforest, jungle rubber, oil palm and rubber monoculture. This research is the first step in a detailed investigation using knockdown insecticide fogging techniques, describing the abundance of Coleopterans throughout the canopy in four different land use systems in Jambi. Canopy fogging was used to assess the abundance of arthropods in different taxa. The objective of this study is to provide a baseline data for biodiversity based on canopy arthropod diversity for Coleoptera.

Figure 1. External morphology (dorsal view) of leaf beetles (*Chrysomelidae*)

Methodology

The study was conducted in 2013/2014 from May-October (dry season) and November-March (rainy season), which is located within and adjacent to two forest reserves in Jambi Province, Sumatra, i.e. Bukit Duabelas National Park and Harapan Rainforest. Arboreal arthropods were collected from the EFForTS core plots, i.e. eight 50 x 50 m plots each in a Rainforest, a Jungle Rubber, and Rubber and Oil Palm plantations. We applied a mixture of petroleum-based 'white oil' with a pyrethrum insecticide (DECIS25, Bayer®) to three target canopies – henceforth referred to as subplots – in each core plot using a SwingFog SN50. To collect arthropods, 16 funnel trays made of nylon were installed with ropes under the canopy, each 1 m^2 fitted with PVC bottles containing 96% ethanol (Figure 1). The insecticide was applied to each tree canopy of oil palm starting from 06.00 am. Each plot was fogged for 20 minutes with the fogging machine operated from the ground to the canopy and moved around to ensure that the area above the trays was covered by insecticide. The collecting traps and bottles were removed two hours after fogging. The samples which had fallen onto the trays were then cleaned from debris, preserved in 96% ethanol and stored at -20° C. The samples were identified to morphospecies level using the book of *American Beetles*.

Results and Discussion

Using this method, we sampled a total of roughly 800.000 individuals in all plots/subplots replicating it in the following season. In terms of numbers, Coleoptera accounted for 25097 individuals out of ca. 250.000 individuals (estimated total of all samplings up to date, in both seasons of 2013/2014). Among the Coleoptera samples we identified four families, which were Chrysomelidae, Curculionidae, Elateridae, and Staphylinidae. Up to date, we have sorted around 13625 individuals into more than 400 different morphospecies. Combining all land use systems and seasons, the most abundant groups were Elateridae (4295 individuals) and Staphylinidae (4089 individuals) dominated as well, followed by Curculionidae (3544 individuals) and Chrysomelidae (1697 individuals). In general, seasonal variations were found higher during rainy season compared to dry season and the total number of individuals varied from season to season.

For family ***Chrysomelidae***, a total of 1697 individual leaf beetles specimen were collected, belonging to 154 morphospecies from 6 subfamilies and 68 genera. The abundance of leaf beetles in the rainy season (1027 individuals; 126 morphospecies) were higher than the dry season (670 individuals; 105 morphospecies). Different landscapes do not give any impact to the abundance and diversity of Chrysomelidae.

For family ***Curculionidae***, 3544 individual true weevils specimen were collected, belonging to 220 morphospecies from 12 subfamilies and 34 genera. The subfamilies with the highest richness in species were Cryptorhynchinae (58 morphospecies), Curculioninae (43 morphospecies) and Conoderinae (25 morphospecies) with *Elaidobius kamerunicus* being the most abundant species with total 1623 individuals in both landscapes. The difference between male and female characteristics of *E. kamerunicus* are that males (Figure 2A) usually have shorter snouts than females (Figure 2B). Also, male *E. kamerunicus* have marginal setae (a), note calluses (b), and setal tuft, while in the female *E. Kamerunicus,* the three characteristics above are absent.

Figure 2. *Elaeidobius kamerunicus* (A) male and (B) female

For family ***Elateridae***, 4295 individual click beetles specimen were collected, belonging to 80 morphospecies from 7 subfamilies and 27 genera. The subfamilies with the highest richness in species were Agrypninae (24 morphospecies), Elaterinae (43 morphospecies) and Cardiophorinae (4 morphospecies). Abundance of click beetles in the rainy season (2436 individuals; 74 morphospecies) was higher than in the dry season (1859 individuals; 50 morphospecies).

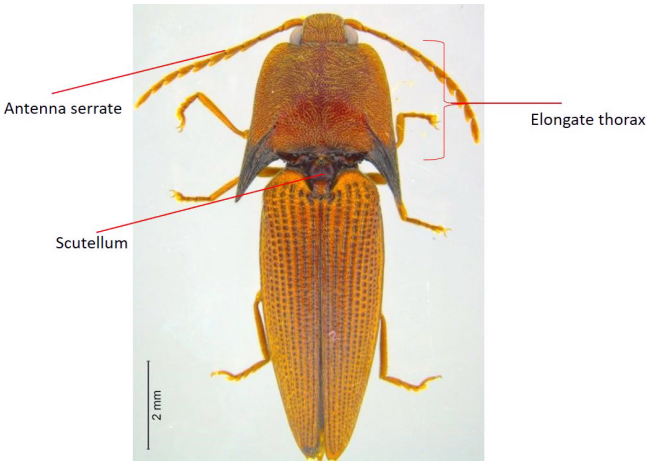

Figure 3. External morphology (dorsal view) of click beetles (Elateridae)

For family ***Staphylinidae***, 4089 individual rove beetles specimen were collected, belonging to 74 morphospecies from 13 subfamilies and 13 genera. The rove beetle samples collected represent about 97.36% of the actual species that are present in both landscapes. Aleocarinae is the subfamily with the highest richness of species that was found in both landscapes.

Conclusion

In general, Coleopterans from 4 subfamilies, which are Chrysomelidae, Curuculionidae, Elateridae and Staphylinidae are more abundant and diverse in rainy season than in the dry season, dominated by Elateridae (4295 individuals; 80 morphospecies) and Staphylinidae (4101 individuals; 74 morphospecies), followed by Curculionidae (3550 individuals; 220 morphospecies) and Chrysomelidae (1710 individuals; 154 morphospecies). The coleopterans specimens collected in this study will help provide an understanding of the diversity that occurs within those land use systems in both seasons. Further studies are needed to identify species richness and diversity of other families from the order Coleoptera and how they interact each other and with the environment.

Figure 4 External morphology (dorsal view) of rove beetles (Elateridae) from subfamily Aleocharinae